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When the Defense Program Reaches Its Peak, in Twelve to Eighteen Months, There Will be Jobs for Six Million More Workers in Industry, Business, Trade and Transportation. Preparations to Meet this Situation Should be Started Now.

Skilled Workers *for* Defense Industries

A Skilled Labor Supply Study

By Charles S. Slocombe

Personnel Research Federation, New York, N. Y.

Authorities in Washington estimate that, when the defense program reaches its peak, in the fall of 1941 and/or spring of 1942, there will be jobs for six million more workers. There will be virtually no unemployed.

Not all these six million extra workers will be employed in defense or manufacturing industries. Extra employment will take place in business, trade and transportation. But probably four million will go into manufacturing.

One Worker in Ten Is Skilled

On the average, in the metal trades, one worker in ten must be a skilled craftsman; blacksmith, carpenter, guage maker, machine setter, millwright, toolmaker, etc. So that the defense program will require an additional four hundred thousand skilled workers.

Where are they to come from? Federal Security Administrator Paul V. McNutt announced in June that there were on the unemployment rolls 657,000 skilled craftsmen. It would appear therefore, at first sight, that there is a sufficient supply of skilled labor in the United States to meet defense program requirements. But—

From 33 to 40 per cent of these workers are 45 years of age or more. If the skill of these men is to be used by industry, men will have to be hired on the basis of skill and experience, without regard to age.

Probably many of the unemployed skilled workers have not worked at their trade for some considerable time. If rehired into industry they would consequently require extensive re-orientation training, and be somewhat inefficient at the start.

It is probable that there will develop an actual shortage of skilled workers in certain key occupations in fast growing new industries. This means that skilled workers with experience in one industry, which is not expanding, may have to be employed by a fast growing industry. For example, a machine tool manufacturer, instead of insisting that a man have experience in that industry before being hired, may find that skilled craftsmen from the business machine manufacturing industry prove satisfactory. Readjustment training would, of course, be necessary.

Many Degrees of Skill

THE word "skilled," as applied to workers, is a very broad classification. There are all degrees of skill. For instance, one company has five grades of toolmakers. There is a possibility therefore that, though the broad picture indicates an adequate supply of skilled labor in the country, there is a real shortage of the most highly skilled workers.

There are two additional sources of skilled workers, apprentices now in training, and production workers with potentialities for development and training into skilled occupations.

On the whole, therefore, it appears that the problem of an adequate supply of skilled labor can be met, though it will require a vast amount of personnel work, especially training, and owing to the time factor involved, peak defense production is likely to be delayed.

Defense Commission Recommendations

TO MINIMIZE the delay, and alleviate the problem, the Labor Division of the Advisory Commission to the Council of National Defense recommends that companies institute upgrade training programs, and carry them out with the aid of transfer services centrally controlled.

Bulletin No. 2 says: "It is essential that top management establish a definite policy of promotion from within in order to train effectively through upgrading. Under this plan one or more individuals are responsible for all placements. They should know as much as possible about the jobs in the plant and about the employees' qualifications to fill them. In addition, employees should be permitted to apply for changes in their jobs without prejudice. An inventory of the working force will classify the employee's potential ability, previous experience, education, his job preference, and length of service. No matter what form this inventory takes—whether through interviews or personnel records, or any other means—such information is essential to training through upgrading."

What results can be expected from such programs? What are the difficulties involved? What different sorts of programs can be set up to meet the special problems of a company?

Survey of Company Practices

IN ORDER to answer these and similar questions, a special survey has been made of the experience of companies in hiring, upgrading, training, setting up a central placement office, surveying anticipated skilled labor requirements, estimating number of employees capable of being upgraded, selecting those capable of benefiting by further training, and the results of segregated training.

The results of this survey are set forth in this report. They show a wide variety of methods and results. Most of the experience is drawn from the 1937 business boom, which is the latest case in which companies experienced great difficulty in obtaining the skilled labor they needed.

A minimum of editorial change has been made in the actual descriptive personnel reports contributed by cooperating companies.

Hiring Skilled Workers

HERE are six instances, dealing with hiring skilled workers by advertisements, out-of-town recruiting, recalling former employees, and through employment agencies. They show the great difficulties (and almost impossibility) of securing the right kind of skilled help by these means.

The only way to overcome this problem would seem to be to hire in at lower levels of skill, and develop the greater skills needed by upgrade training programs within the plant.

Don't Advertize for Skilled Help

DURING the past two years we used the medium of newspaper advertising quite extensively. For the most part we used the local daily and Sunday newspaper. We must admit that little success was had through this method. In order to illustrate how difficult it was to secure skilled help for our tool and machine departments, we have selected a blind ad which was inserted in an issue of the Sunday paper, and the following summary will indicate the results obtained:

	Number
Replies received	173
Not acceptable for employment	96
Applications sent to those whom we considered favorable	77
Did not reply by returning application	19
Applications returned but applications not suitable	6
Applications returned to and referred to line organization	52
Applications sent back to Employment Department by line organization as unsatisfactory prospects	25
Applicants who were asked to call for an interview	27
Applicants who were interviewed and not hired	14
Applicants who did not report for interview	3
Applicants who were interviewed and hired	10
Hired but did not report for work	4
Hired and reported for work	6

Thus it can be seen that out of a total of 173 replies to an advertisement, we were able to secure only 6 mechanics who could meet our requirements. A summary of results from other advertisements would indicate this same lack of success.

Another Company's Experience

CONTACTING new employees through blind advertising was a discouraging experience, as in 557 additions to the skilled classifications, it was possible to secure only 10 individuals in the skilled occupations through the use of blind adver-

tising. In many instances the entire returns from a day's advertising did not result in finding a single capable candidate.

Our records also indicate that of the 557 additions of new skilled help, 84 were employed from applicants recommended by public and private employment agencies; 121 skilled workers were employed as a result of recommendations to the employment office by present employees and friends of the company; 10 were secured through the use of advertising. The remaining 342 of the 557 additions to the skilled force were hired over the counter.

Out-of-town Recruiting

In contacting applicants from "out-of-town" areas the same unsatisfactory experience was had as in the use of blind advertising and employment agencies. In some "out-of-town" areas local newspapers would not accept blind advertising, and in many instances employment agencies refused to recommend applicants for interview by "out-of-town" employers. In addition, instances were recorded where local chambers of commerce and metal trades associations brought pressure to bear on "out-of-town" employers to restrain them from disturbing local labor markets.

Our records indicate that late in 1936 and early 1937, 90 skilled workers were hired from "out-of-town" areas, but that only 37 actually reported for work, and of this number 8 were lost during the first two weeks to return to the point from which employed.

Recalling Former Employees

During our expansion which covered the period 1935–37, we wrote to 205 former employees in skilled classifications to determine if such employees were employed and if they were interested in returning to their former jobs. The result of the 205 letters was as follows:

82 employees replied, indicating an interest in securing more information relative to returning to their former jobs.
15 were not interested in returning.
3 expressed no opinion.
44 did not reply to the letter.
2 were deceased.
59 letters were returned—unable to find.

As a result of contacts established through the 205 letters written, 36 former employees in skilled classifications were finally rehired.

Former employees indicating an interest in securing more information relative to returning to their former jobs, but who eventually refused to accept employment, did so principally for the following reasons:

(a) Guarantees of permanent employment requested, which could not be made.
(b) Present employment more to their liking.

(c) In business for themselves and did not wish to change.
(d) Receiving rates of pay in excess of those offered.
(e) Employed at distant locations, too far removed from the plant.
(f) Reluctance to accept because of fear of loss of skill.

Our data also indicate that former employees considered for reemployment make comparisons between employers on such matters as the following in deciding whether or not they should return to their former jobs:

(a) Company reputation.
(b) Wages and Working conditions.
(c) Stability of employer's business.
(d) Benefits which accrue from service or seniority rights.

It is also necessary for a former employee who has moved out of the plant area to consider carefully the expense involved in moving household effects and family as well as the effects of uprooting his family, such as changes in school for children, and the separation of the family from established friends.

Using Employment Agencies

During the last quarter of 1936 and the first quarter of 1937 there was a further tightening up in the supply of skilled and semi-skilled help in the area, with a definite shortage developing. Other companies were losing some of their semi-skilled and skilled men, and the only skilled help obtainable in the area seemed to be those tradesmen who were endeavoring to capitalize on the situation and were shopping around from plant to plant to obtain the best possible offer of wages and working conditions.

TABLE 1

REASONS FOR REJECTION

	INTER-VIEWED	HIRED	NOT CAPABLE	AGE	MEDICAL	RATE	MISC.
Nov. 1936	205	67	116	5	4	5	8
Dec. 1936	353	96	121	8	5	2	21
Jan. 1937	320	59	196	3	4	1	57
Feb. 1937	276	73	169	6	3	2	23
Mar. 1937	339	87	220	3	8	1	20
Apr. 1937	228	64	135	1	4	3	21
May 1937	167	26	122	5	4	1	9
June 1937	282	41	230	3	2	1	9
July 1937	110	16	89	2	—	—	—
	2,280	529	1,398	36	34	16	171

At about this time employment agencies in the area were contacted, and as a result the Employment office was overrun with individuals claiming experience in the semi-skilled and skilled trades. Some of these applicants could not meet our Medical Department requirements; others had been away from the trade so

long that an extended period of re-orientation training would be required; and still others were totally unsuited to the company's work. Following is a summary of the interviewing and employment activity for semi-skilled and skilled labor during this period: (Table 1).

About 60% of the applicants did not qualify for the job requirements and it was necessary for the Employment Department to continually contact the employment agencies in an endeavor to impress upon them the need for adhering to specified requirements and qualifications in sending applicants for interview.

Poorer Men for Better Jobs

As the period of hiring activity and "recovery" progressed from October, 1935, to December, 1936, the general caliber of all the men hired, both skilled and production, dropped off with respect to education, mental alertness and ability to solve problems in spatial relations. This same trend is true of personnel ratings. At the same time the initial or "starting" labor grades of the men were increasing. In other words, as time went on the company was hiring less and less capable men, and placing them on higher and higher graded jobs. (See Chart I.)

It does not follow that these higher grade starting jobs should have been filled by upgrading very short service and inexperienced employees, because of the double training costs and interference with production involved.

These trends were also accompanied by a tendency to hire more "outsiders" as the period progressed.

All of these trends took an upward turn in January–March, 1937. These trends suggest the problem of systematic changes in the caliber of applicants, and in selection standards as a result of business upturns. If such changes are general characteristics of the present period of hiring activity, they suggest modifications of employment procedure, particularly the hiring of lower skilled workers, who are fully expected to require, and be capable of further training by the Company.

Requirements for skilled employees during the latter part of 1935 were completely filled by recalling former employees, while in 1936 it became necessary to hire 57 new employees or 19.7% of the total. This was increased to 98 or 33.6% of the total in 1937. Unquestionably, the shortage would have become more acute had our requirements for this class of help not declined after August, 1937.

Men Demand More Pay

It was our experience during the 1935–36–37 "build-up" that the difficulties encountered in obtaining mechanics to meet the requirements of tool building were more pronounced than in former years. This can be largely attributed to improved methods (e.g., splitting and grinding dies, hobbing of plastic molding dies, etc.) of constructing tools, as well as to the more complicated design of the tools themselves.

CHART Ia. Intelligence Test Otis

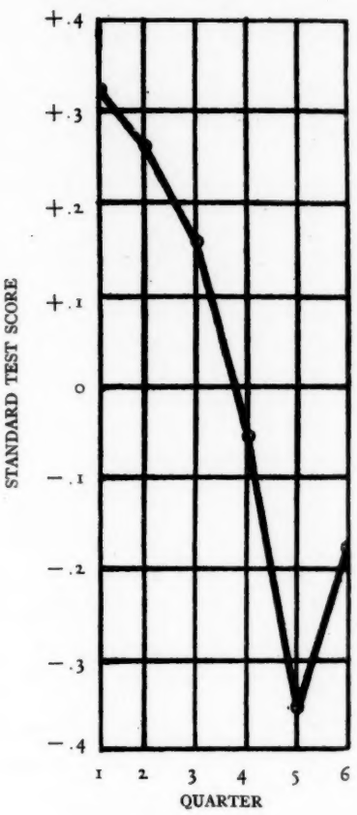


CHART Ib. Spatial Relations Test Minnesota Paper Form Board

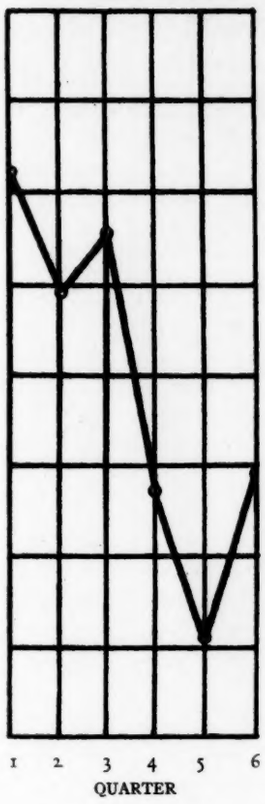
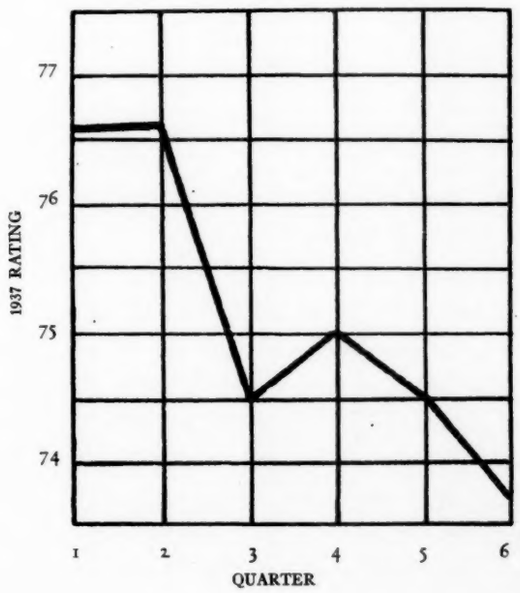


CHART Ic. Trends in Personnel Ratings



The modern tendency in the design of tools is to replace the several tools, which were formerly necessary to perform the several operations incident to the fabrication of a piece part, with one tool so designed that it performs the required operations (blanking, forming, drawing, perforating, notching, etc.) all at once.

While this means that some of our mechanics (grinding machine operators, lathe hands, etc.) must become more highly skilled in their specialty, it also means that most of our toolmakers must have a greater over-all knowledge of their trade than before.

We found that in order to obtain highly specialized and competent mechanics from the outside, we had to offer higher wages than in former years. Each good mechanic understood that due to a shortage of help in his field, he could hold out for a better starting rate, especially if he qualified for the job in every other respect.

Upgrading Skilled Workers

WHAT sort of results may be obtained by upgrading? Chart II on p. 130 shows the results obtained in 1937 by a company with an average working force of 1850 shop employees.

In the skilled labor grades (7–11) the average force was 411. 203 of these were obtained by hiring, and there were 75 upgrade promotions. All hiring was done in the lower skilled labor grades, where the labor market is least tight. *Under this plan, it was not found necessary to hire anyone for the two highest skilled labor grades.* Of 29 men in these highest grades 20 were obtained by promotion from lower grades.

The same thing is largely true of production workers (labor grades 1–6). With an average working force of 1439, 907 were hired in the lowest grades, and of these 757 were promoted during the year. It was thus found necessary to hire only 20 workers for the most skilled production jobs.

Internal Problems Created

WHILE such a program avoids the tremendous difficulties of obtaining the higher grades of skilled craft, and production workers from the general labor market, it can be well seen that it does create other knotty problems within the organization.

(1) A man leaving one job to go to another higher one, either in his own department or in another, must take some time to readjust himself. During this period his efficiency will be lower than normal. The enormous number of such promotions in this plant during one year would seemingly therefore have reduced the overall efficiency of the plant.

(2) It throws an extra burden on the supervisory force, for these promoted men will all require some additional instruction to fit them for their new duties, and also extra supervision in assigning and inspecting work.

(3) The supervisory force must be sold on the overall benefits of the program. For a supervisor with a good man in his department, capable of promotion, will have a natural tendency to want to keep the man in his department, rather than let him go to another department, and be replaced by a temporarily less efficient man promoted from some lower labor grade.

(4) Where a union is involved, and particularly where promotion is normally wholly or largely determined by seniority, difficult negotiations will be necessary to gain the union's acceptance of the plan.

NUMERICAL DISTRIBUTION OF AVERAGE WORKING FORCE, HIRINGS AND PROMOTIONS DURING 1937

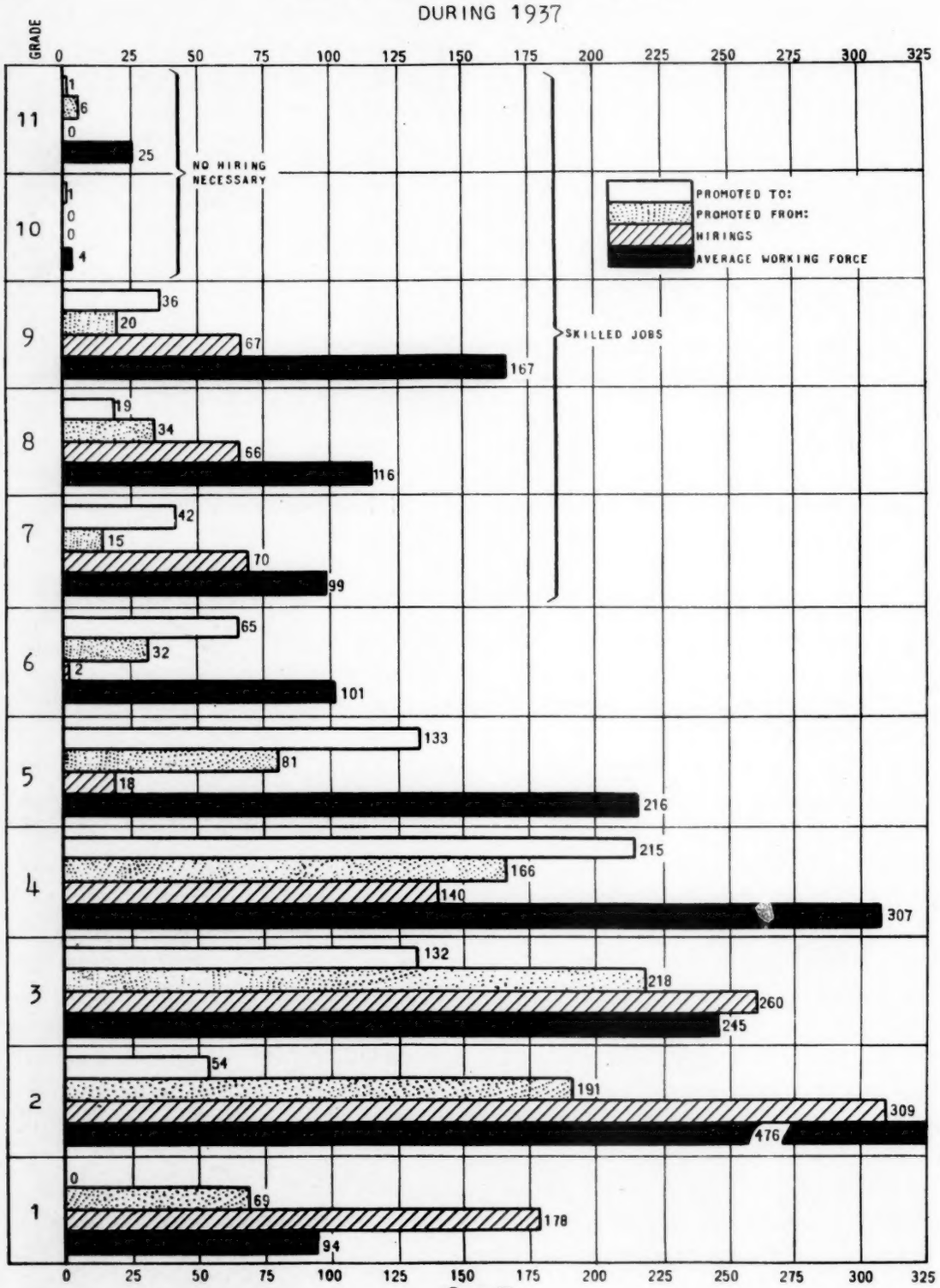


CHART II

The results shown for this company for the tight labor market year, 1937, grew out of a memorandum from the employment manager to the plant manager. A copy of this memorandum, which describes the operation of the plan, is here included.

Letter Starting Program

To Plant Manager

Several weeks back you reqested me to line up a plan to provide for upgrading employees already on the payroll to higher rated jobs.

After considering several different plans, we at last decided on one which has been in force generally throughout the plant, although it has never been drawn up in a definite form to which all units might subscribe.

Because we had completed a job analysis of all occupations in one unit, we have used that organization in an endeavor to formulate a definite plan to insure that all new employees will come into the plant at the lower grades, and that openings in the higher grades will be filled by promoting from the lower grades.

Upgrading Chart Prepared

For this purpose we have drawn up a chart, along with a detailed statement, which for want of a better name we have termed "upgrading chart". It has been designed for the purpose of assisting supervisors in the rather difficult task of upgrading their people. It serves the purpose of giving a definite picture of the promotional opportunities opening before employees, and reveals from what occupations employees can be promoted most logically, and from what occupations they can be promoted most logically to certain positions. (Chart not included.)

Blocks show each non-supervisory occupation in a department; and circles, supervisory occupations. Occupational grades, approved, tentative and proposed are included for each division.

The lines, with arrows pointing in the direction the line is supposed to travel, indicate the path of progress between each occupation. Lateral lines in many instances show inter-divisional moves and possibilities such as inducting inspection personnel from operating and production divisions.

In the lower levels all jobs are interchangeable. In this way flexibility is assured and workers are less likely to grow stagnant by remaining too long in the lower levels. In following out the plan it is intended that practically all new employees will come in at the lower levels and turnover should be confined almost exclusively to these lower grades.

As the chart is drawn up, there are no dead-end jobs. While we recognize that there are certain employees who will reach their proper level, and most likely be dead-ended at that particular point after a period, we believe it would be undesirable to indicate that condition on the chart, and that it is quite likely that some employees of this group may be transferred to other branches where it is pos-

sible that further progress may be made in a line of work for which they are better fitted.

Serious consideration has been given also to the progress of women workers. We believe it is not only desirable to upgrade them on shop jobs, but also to effect shop to office transfers as special abilities of employees permit.

We are not unmindful of the fact that not every employee working in a given occupation may be properly transferred to one of the occupations the path of progress indicates, and exceptions will arise.

Minimum Period on One Job

In presenting the plan, we are reminded that in times when there is an abnormal demand for labor it is likely that not all of the higher graded jobs can be filled from the lower grades, and that some employees should be expected to remain within lower grade occupations or in other words, in the jobs in which they started, for at least a minimum period of time. We believe this minimum period could best be set by the line organization, although of course it is conceivable that some unusual workers will come in from time to time, and it may be found desirable to promote them before the minimum time has expired.

Hiring Only in Lowest Grades

As I said in the beginning, the plan we are presenting is in general along the lines the various organizations are attempting to follow, and which we feel they have followed with a certain degree of success. For that reason we believe there should be no serious objection to accepting a plan of this sort as a definite policy, bearing in mind that its success will be indicated only by the amount of support it is given by the line organization.

Naturally if the plan is accepted, our Employment department will use the chart as a guide for filling requisitions received for labor. In other words, any requisitions for labor above the two lowest grades will not be acted upon by the Employment organization until they are satisfied that the labor required cannot be obtained from lower grades somewhere in the plant. We should expect the superintendent in charge of the organization entering the requisition to approve hiring a new employee from outside sources.

Should the plan be accepted, additional charts will be drawn up for the other departments in the plant so that inter-department rotation and upgrading may be worked out to insure that any requirement for labor above the two lowest grades, regardless of where it is in the plant, will be filled from the lower grades of any one of the departments; that is, assuming that the department entering the requisition have exhausted their possibilities of obtaining a man from a lower grade, the Employment organization will offer the promotional possibility to employees in the lower grades in some other unit.

Employment Manager.

Special Emergency Training

Is upgrade training feasible? Is it practical? What sort of results may be obtained from it? Does it ease the pressure in a tight labor market? These are legitimate questions. They are answered in the experience of one company.

In a period of expanding business, when it was found difficult to hire skilled workers, it set up a training program for its machine shop employees. They were trained in operation and care of machines, grinding of tools, setting up machines from blueprints, and in the use of simple and complicated measuring tools.

Program 98% Successful

Of 92 men in the shop, 70 were trained during 9 months. 69 benefitted so much by the training that they qualified to do more highly skilled work than they had previously, and were promoted accordingly.

The output of the shop increased 10%, the number of inspection rejections was reduced by 15%, and the skilled labor problem of the company was substantially eased.

Special Intensive Training

This company engaged in special intensive job training in two departments to meet needs for workers with greater skill. In one department trained detail makers and machine operators were required and unavailable in the outside market, so that a program of raising the level of skill was started in 1937 and continued until June 1938.

Selection of Trainees

Company employees recommended by supervisors on the basis of performance within the department concerned.

Operation of the Plan

With a training manual developed by the training department, instructors specially trained were assigned 20 trainees each. These instructors were responsible for fully instructing the trainees in the operations involved in the next higher class of labor. They also coordinated classroom work with productive work, and worked closely with the supervisors of the trainees. As a trainee was qualified for the next higher class of work, his training was terminated and he was replaced by a new candidate from the department. The training period varied from 6 to 12 weeks, depending upon the base skill and ability of the trainee.

In another department where it was necessary to develop increased skill in machine operators, a similar plan was followed.

Resume of Results

THE training plan made available workers with increased skill to meet immediate and anticipated needs. In the Assembly Department 114 employees were placed in training during a 9-months period, and 65 upgradings were possible as a result. An interesting observation was that the quality of the department in which this training took place definitely and substantially improved as a result. This contributed to improved use of bench and machine tools.

The training activity created a tremendous interest among the trainees, who sought mechanical trades extension courses on their own time to secure knowledge related to their work. 107 of the 114 trainees enrolled for such courses. (See Table 2.)

TABLE 2

RESULTS IN TWO DEPARTMENTS

Assembly Department:		
Number on roll at time training began		135
Number trained during 9-months period		114
Number of employees promoted 1 class	49	
Number of employees promoted 2 classes	8	
Total number of employees promoted		57
Total number of promotions		65
Classroom training—2 hours weekly		
Shop instruction—2 hours weekly		
Total training period—6 to 12 weeks per class promotion		
Trained in the use of simple and complicated bench tools, simple and complicated measuring tools, and theory of close fitting and lapping.		
Approximately 10% of trainees selected for training failed to profit thereby, and the balance of the group were not promoted due to lack of openings at the higher level, brought about by a recession in business.		
Machine Shop:		
Number on roll at time training began		92
Number trained during 9-months period		70
Number of employees promoted 1 class	64	
Number of employees promoted 2 classes	4	
Number of employees promoted 3 classes	1	
Total number of employees promoted		69
Total number of promotions		75
15% reduction in inspection rejections observed following training. Output had increased approximately 10%.		
Classroom training—2 hours weekly		
Shop instruction—2 hours weekly		
Total training period—6 to 12 weeks per class promotion		
Trained in operation and care of machine, grinding of tools, setting up machine from blueprint and in the use of simple and complicated measuring tools.		

Progression Training

MANY companies feel that, under the present and oncoming emergency defense situation, they can no longer rely solely upon formal apprentice training programs for their supply of highly skilled workers.

One company has developed, what it calls, a supplementary plan of "progression training". Under this plan employees, recommended by supervisors and tested as to mental capacity, are trained through a planned sequence of jobs. Each man moves along at a pace determined by his own ability to progress. Some, of course do not go right through to the most all-round skilled jobs, but showing special aptitudes and limitations, become specialists as, milling machine operators, grinders, machinists, heat treaters, etc.

Results Obtained

WHAT sort of results may be expected from such a plan? The company found that after it had been in operation twenty months of 109 men:

7 completed training as toolmakers
1 as an instrument maker
1 as a hand screw machine specialist
6 accepted supervisory positions
1 transferred out at his own request
11 failed to assimilate training

of the remaining 82, the expectations were that they would develop as follows:

17 toolmakers
20 lathe specialists
20 milling machine specialists
10 hand screw machine operators
10 automatic screw machine operators
5 grinder specialists
10 drill press specialists
10 punch press specialists

Supervisors Developed

SUCH a program obviously develops men at a slower pace than the emergency training program described above. Yet it has the advantage of increasing the amount of skill acquired to a much greater extent.

It will be noted also, that in this program, a proportion of the men developed supervisory ability, and were promoted to supervisory jobs.

The progression training program was designed to train semi-skilled and skilled workers in higher levels of work by planned progression and upgrading in production shops to meet the needs of the company. With the knowledge that only a small ratio of apprentices who start training, even in highly specialized training shops, ever become toolmakers, the company planned to develop and use the maximum amount of skill that could be obtained by training present employees.

This plan allowed trainees to reach their maximum skill limitations even though they did not finally qualify as toolmakers. By careful selection and guidance, first-class machine operators can be trained from those who will not qualify as toolmakers on such machines as lathes, milling machines, grinders, hand and automatic screw machines, drill and punch presses.

Selection of Trainees

To be accepted a trainee must have been recommended by a shop supervisor based on quality and quantity of work and potentialities. An occupational test was given and followed by a training interview. From this group the candidates thought most likely to succeed were selected as trainees by the training department.

Operation of the Plan

The training department assigned a representative to approximately 30 trainees, whose duty it was to arrange for all upgradings and transfers to pre-determined work assignments; to arrange for sale of tools to trainees; to contact shop supervisors or the instructor weekly to determine the progress of the trainee; to determine with shop supervisor or instructor if trainee was ready for new assignment; to determine classroom work to be assigned trainee; to interview trainees weekly to discuss progress and obtain reactions, which was considered as an aid in employee development; and to coordinate shop assignments with classroom work.

Each trainee was to be placed on suitable assignment in the shop at the lowest training point and to attend classroom instruction away from production for three hours weekly on company time; each shop supervisor, instructor, classroom instructor and the training department representative to analyze each trainee periodically to determine for what skilled mechanical trade each trainee was best suited.

Payment of Trainees

The trainee received the same rate of pay he received for his usual shop work. Each assignment was evaluated in terms of units and these units divided into pay ranges. The hourly rate of each trainee was increased as soon as he had sufficient credits to place him in the next higher classification.

TABLE 3

Trainee Progression

2ND GRADE START

12 Bench Hands failed
2 Saw Operators to Grade 3 Drill Press Operators
1 Bench Hand to Grade 3 Milling Machine Operators
2 Bench Hands to Grade 4 Detail Makers
2 Drill Press Operators to Grade 4 Drill Press Operators
2 Bench Hands to Grade 4 Lathe Operators
4 Drill Press Operators to Grade 5 Mill Operators
2 Punch Press to Grade 6 Lathe
3 Drill Press to Grade 6 Hand Screw Machine
1 Bench Hand to Grade 6 Detail Maker then to Supervisor

3RD GRADE START

1 Adjuster to Grade 4 Mill
2 Mill Operators to Grade 4 Mill
1 Lathe Operator to Grade 4 Operator
1 Lathe Operator to Grade 5 Operator

4TH GRADE START

2 Bench Hands to Grade 4 Drill
1 Counter to Grade 4 Grinder
2 Counters to Grade 4 Saw
3 Drill Press to Grade 4 Mill Operators
2 Saw Operators to Grade 4 Lathe Operators
6 Punch Press to Grade 5 Punch Press
5 Drill Press to Grade 5 Drill Press
2 Detail Makers to Grade 5 Lathe Operators
5 Detail Makers to Grade 6 Lathe
5 Detail Makers to Grade 6 Mill Operators
1 Mill Operator to Grade 6 Mill Operator
3 Punch Press Operator to Grade 6 Punch Press to Supervisor
1 Punch Press Operator to Grade 6 Hand Screw Machine Operator (Completed)

5TH GRADE START

3 Oilers to Grade 4 Detail Makers
2 Inspectors to Grade 5 Drill Press
4 Punch Press to Grade 5 Lathe
1 Drill Press to Grade 5 Mill
2 Machine Operators to Grade 6 Drill Press
1 Punch Press to Grade 6 Punch Press
1 Punch Press to Grade 6 Punch Press to Group Chief
1 Detail Maker to Grade 7 Detail Maker

6TH GRADE START

2 Assemblers to Grade 6 Drill Press
2 Lathe to Grade 6 Detail Makers
3 Mill Operator to Grade 6 Detail Makers
2 Detail Makers to Grade 7 Tool Makers (Completed)
1 Detail Maker to Grade 7 Instrument Maker (Completed)
1 Detail Maker to Grade 8 Tool Maker (Completed)
1 Punch Press to Grade 8 Punch Press to Supervisor

7TH GRADE START

2 Machinist to Grade 7 Machinist
2 Detail Makers to Grade 7 Detail Makers
4 Detail Makers on Jigs and Fixtures to Grade 8 Tool Makers (Completed)

Training Results

One hundred and nine trainees were placed on training between August 1936 and August 1937, and this training was suspended May 1938. At the termination we had 82 still on training; the other 27 were dropped for the following reasons: 7 completed training as toolmakers, 1 as an instrument maker, 1 as a hand screw machine specialist, 11 failed to assimilate training, 1 was transferred out at his own request, and 6 accepted supervisory positions in the shops.

Analysis shows that the 82 remaining trainees would develop into skilled mechanics as follows: 17 toolmakers, 20 lathe specialists, 20 milling machine specialists, 10 hand screw machine operators, 10 automatic screw machine operators, 5 grinder specialists, 10 each drill and punch press specialists. Progress charts on each individual in effect at the time training was suspended indicated that approximately 20 trainees would complete their training each year, some of each in the above work classifications (see Table 3).

Occupational Test Results

One hundred and nine trainees were selected for training with the following occupational test results: 23 above average, 63 average and 23 below average. In May 1938 when training was suspended, the training marks on these 109 trainees were as follows; of the 23 who were outstanding on tests 16 had above average marks and 7 had average marks; of the 63 who had average test marks 26 were outstanding, 35 were average and 2 below average; of the 23 below average on the test 14 had average training ratings and 9 below average.

Time Taken to Learn Jobs

IF SKILLED workers are trained by a company, how long does it take them to learn, so that their efficiency comes up to the standard set for the job?

There are four problems here:

If a fully skilled or qualified worker is hired from the outside, or transferred to another department or job within the plant, how long is it before he learns the fundamentals, or routines of the job, so that he can proceed without further detailed instruction and supervision?

After he has reached such a stage, he will still not be up to normal proficiency for the job, but as time goes on will, through practice and learning by himself, improve until the quality and quantity of his work is up to the standards set for the job. How long does this take?

These two learning times for different jobs at various levels of skill are shown, for one company in Table 4 that follows.

New and Upgraded Workers

IF A new inexperienced worker is hired, and specializes in a skilled occupation, how long will it take him to acquire full proficiency?

If a skilled worker is fully qualified in one labor grade, and is promoted to the next higher grade in the same occupation in the same plant, how long does it take him to meet the normal performance standards of his new job?

These learning or training periods are shown, for one company in Table 5 below.

Time to Secure Efficient Force

THESE figures were compiled by the company to get a more complete picture of the time required to secure an efficient working force, with its expected increase in defense and other business.

All available job analyses written on the skilled trades and machine occupations were studied and information on them concerning learning, or time to reach normal efficiency, tabulated. Where unavailable, this information was taken from training records, or obtained from supervisors who had men reporting to them in that line of work.

TABLE 4

Table of Skilled Trades and Machine Occupations with Learning Period, Time Required to Reach Normal Proficiency, Experience Required and Experience Preferred

Occupation	(A) Learning time in weeks for experienced workers	(B) Normal profic. in weeks includes (A)	Previous experience	
			Required in months	Preferred in months
Class 2				
Drill Press Operator, Light	4	12	—	2
Class 3				
Drill Press Oper., Light	4	8	2	6
Milling Mach. Oper., Simple Work	8	10	—	6
Polisher & Buffer	8	12	—	3
Class 4				
Box Maker	6	24	3	12
Buffer, Metal	8	24	6	12
Spec. Mach. Operator	4	24	—	12
Detail Maker	10	24	8	12
Drill Press Oper., Heavy	4	24	12	24
Drill Press Oper., Light	4	24	12	24
Grinder, Rough	4	12	6	12
Heading Mach. Oper	8	24	6	12
Helper, Plant Trades	8	24	—	6
Milling Mach. Oper., Prod.	8	12	6	12
Milling Mach. Oper., Simple Work	8	12	4	6
Nailing Machine Operator	4	8	3	6
Painter, Metal	4	8	3	6
Polisher and Buffer (Rubber)	4	6	6	12
Punch Press Operator	4	12	9	18
Sandblast Operator	4	12	—	12
Sander, Hand	4	12	4	12
Sheet Metal Worker, Prod.	6	24	3	6
Shear Oper., Power	4	16	6	12
Welder, Electric Spot	8	24	6	12
Wood Finisher	4	12	12	24
Class 5				
Buffer, Metal	8	24	24	18*
Spec. Mach. Operator	4	12	12	24
Drill Press Operator, Heavy	8	24	18	24
Drill Press Operator, Light	6	24	18	24
Glue Press Operator	4	12	12	18
Grinder, Rough	4	12	18	24
Hand Screw Machine Operator	4	12	12	18
Joint Operator	4	14	12	18
Layout Man	12	36	24	30
Milling Mach. Oper., Production	6	24	18	24
Milling Mach. Oper., Simple Work	6	24	18	24
Plater, Metal Finishes	12	36	24	36
Punch Press Operator	4	24	12	18

TABLE 4—*Continued*

OCCUPATION	(A) LEARNING TIME IN WEEKS FOR EXPERIENCED WORKERS	(B) NORMAL PROFIC. IN WEEKS INCLUDES (A)	PREVIOUS EXPERIENCE	
			Required in months	Preferred in months
Class 5—*Continued*				
Sander, Hand	8	18	18	24
Saw Operator (Metal)	4	12	12	18
Saw Filer	4	12	36	48
Sawyer, Rip	4	16	18	24
Sawyer, Swing	4	16	18	24
Sawyer, Trim	4	16	18	24
Shaper Operator, Wood	4	20	12	18
Shear Operator, Power	4	12	12	18
Sheet Metal Worker, Plant, Simple Work	8	24	18	24
Sprayer, Metal	6	24	24	36
Sprayer, Wood	8	24	12	18
Welder, Electric Spot	4	12	12	24
Class 6				
Blacksmith, General	8	24	36	48
Buffer, Metal	16	24	36	24†
Cabinet Maker	16	24	36	48
Spec. Mach. Operator	4	16	24	30
Detail Maker	10	32	24	12 Co. exp.
Ext. Press Oper	8	16	30 Co. exp.	36 " "
Hand Screw Machine Operator	4	10	24	36
Lathe Oper., Bench or Eng.-Prod	4	10	24	36
Machine Setter, Punch Press	16	24	30	36
Machine Setter, Metal and App	16	24	30	36
Milling Mach. Oper., Precision	8	18	24	36
Milling Mach. Oper., Production	8	18	24	36
Plater, Metal Finishes	16	32	36	36 Co. exp.
Punch Press Operator	4	24	24	36†
Sander, Machine	8	16	18	24
Saw Operator, Metal	4	12	24	36
Sawyer, Rip	4	12	24	36
Sawyer, Trim	8	24	24	36
Shaper Operator, Wood	4	24	18	24
Sprayer, Metal	6	18	36	60
Sprayer, Wood	8	24	18	24
Wood Finisher, All Around	4	12	24	36
Wood Finisher, Varnisher	4	12	24	36
Class 7				
Buffer (Polisher) Metal	20	28	48	42 Co. exp.
Cabinet Maker	16	24	36	48
Carpenter	8	16	30	36
Detail Maker	10	16	36	36 Co. exp.
Die Maker	14	24	36	12* Co. exp.
Electrician	12	24	12‡	12* " "
Grinding Mach. Oper.—Precision	6	24	24	24 " "
Grinding Mach. Oper.—Cutter	6	24	24	24 " "
Hand Screw Machine Operator	4	12	30	36

TABLE 4—*Continued*

OCCUPATION	(A) LEARNING TIME IN WEEKS FOR EXPERIENCED WORKERS	(B) NORMAL PROFIC. IN WEEKS INCLUDES (A)	PREVIOUS EXPERIENCE	
			Required in months	Preferred in months
Class 7—*Continued*				
Instrument Maker	10	24	36	48
Lathe Operator, Turret, Bench or Engine—Precision	4	8	30	24 Co. exp.
Lathe Oper., Auto. Wood Turning	6	12	30	24 " "
Layout Man	10	24	36	48
Machine Setter, Punch Press	8	16	36	36 12 Co.
Machine Setter, Metal and App.	8	16	36	36 " "
Mach. Setter, Contact Wld. Mach.	4	8	36	36 " "
Machinist (Gen.—Plant Repairman)	16	52	48	48 Co. exp.
Mason & Cement Fin., Cement Fin.	4	8	36	48
Millwright	16	52	24	36
Painter, General	4	8	24	36
Plumber (pipefitter)	12	16	24	36
Sawyer, Swing	8	16	36	36 Co. exp.
Screw Mach. Oper., Auto.	4	8	24	24 12 Co.
Sheet Metal Worker, Plant, All Around	8	20	24	36
Sheet Metal Worker, Plant, Simple Work	8	16	24	36
Sign Letterer	4	16	12	18
Toolmaker	14	24	12‡	24‡
Welder, Elec. Arc & Acetylene	8	16	24	36
Class 8				
Blacksmith, General	8	16	48	48 incl. 12 Co.
Cabinet Maker	16	24	48	48 " " "
Carpenter	8	16	42	48
Detail Maker	8	16	48	48 " " "
Electrician	12	24	48	48 Co. exp.
Grind. Mach. Oper., Precision	10	24	36	36 " "
Lathe Oper., Turret, Bench or Engine—Precision	6	12	36	36 " "
Locksmith	4	6	24	36
Machinist (Gen.—Plant Repairman)	12	36	48	48
Mason & Cement Fin., Bricklayer	4	8	48	48 Co. exp.
Mason & Cement Fin., Cement Fin.	4	8	48	48 " "
Milling Mach. Oper.—Precision	6	12	36	48
Millwright	16	52	36	48
Plumber (Pipefitter)	16	32	36	36 Maint.
Sawyer, Trim	8	16	36	36
Screw Mach. Oper., Automatic	6	12	36	48
Sheet Metal Worker—Production	8	16	48	48
Sheet Metal Worker—Plant All Around	16	52	48	48
Welder, Elec. Arc and Acetylene	8	16	36	48
Class 9				
Cabinet Maker	20	52	60	60
Detail Maker	6	12	60	24 Co. exp.
Die Maker, Maker and Repairer	14	24	24‡	36‡ incl. 12 Co.
Electrician	12	24	60	60 Co. exp.

TABLE 4—*Concluded*

OCCUPATION	(A) LEARNING TIME IN WEEKS FOR EXPERIENCED WORKERS	(B) NORMAL PROFIC. IN WEEKS INCLUDES (A)	PREVIOUS EXPERIENCE	
			Required in months	Preferred in months
Class 9—*Continued*				
Engineer	16	52	48	60§
Grind. Mach. Oper., Precision	6	16	36	48
Instrument Maker	10	36	60	—
Lathe Oper., Tur., Bench or Eng. Prec.	6	20	48	48 Co. exp.
Mach. Setter, Auto. or Hand Screw	8	20	36	48
Machinist, (Gen.-Plant Repairman)	6	16	60	60 incl. 12 Co.
Milling Mach. Oper.—Precision	6	12	48	60
Millwright	24	52	48	60
Pattern Maker, Wood	8	16	24‡	36‡
Plumber (Pipefitter)	16	32	48	48
Toolmaker	14	24	24‡	36‡
Vernier Machine Operator	6	20		
Class 10				
Grinding Mach. Oper.—Precision	6	24	48	60
Toolmaker	14	24	36‡	48‡
Class 11				
Die Maker, Maker and Repairer	14	24	84	84
Gauge Maker	12	24	84	84 incl. 12
Heat Treater, Tools	4	8	72	72 Co. exp.
Toolmaker	14	24	84	84
Not Classed				
Mach. Setter, Auto. or Hand Screw	8	20	72	72
Mach. Setter, Metal and Apparatus	8	20	60	60
Mach. Setter, Cont. Weld. Machine	4	12	72	72 incl. 12
Mach. Setter, Wood Working	4	12	66	66 Co. exp.
Toolmaker	14	24	84	84

* Preferred 18 months in specialized type of buffing.

† Preferred specialized type.

‡ Plus apprenticeship.

§ Must have State refrigeration and stationary engineering license.

TABLE 5

TRAINING PERIODS FOR THE MECHANICAL TRADES (FROM TRAINING DATA)

A. These learning periods represent the total time required for an *inexperienced* operator to attain the job performance standard if he specializes in that occupation.

B. These learning periods represent the number of weeks required for an operator *experienced* in the next lower class to meet the performance standards of job shown.

OCCUPATION	CLASS	WEEKS	
		A	B
Lathe Operator	2	4	3
	4	10	8
	5	14	6
	6	20	8
	7	24	6
	8	28	6
	9	32	6
Milling Machine Operator	2	4	3
	3	10	8
	4	16	8
	5	20	6
	6	26	8
	8	30	6
	9	34	6
Drill Press Operator	2	6	4
	3	8	4
	4	10	4
	5	12	4
	8	14	4
Grinding Machine Operator	2	3	3
	3	4	3
	4	6	4
	5	8	4
	6	14	8
	7	18	6
	8	26	10
	9	30	6
	10	34	6
Punch Press Operator	2	4	3
	3	5	3
	4	7	4
	5	9	4
	6	11	4
	7	13	4
Saw Operator	3	3	3
	4	4	3
	5	5	3
	6	6	3

TABLE 5—*Continued*

OCCUPATION	CLASS	WEEKS	
		A	B
Shear Operator	3	3	3
	4	4	3
	5	5	3
Hand Screw Machine Operator	3	3	3
	4	5	4
	5	7	4
	6	9	4
	7	11	4
Detail Maker	4	60	10
	6	135	10
	7	183	10
	9	279	6
Auto. Screw Machine Operator	4	6	6
	5	10	6
	6	14	6
	7	18	6
	8	22	6
	9	26	6
Engraving Machine Operator	5	4	4
	6	8	6
Jig Borer Operator	6		
	8		
	9		
Planer Operator	6	6	6
	9	10	6
Shaper Operator	6	6	6
	8	10	6
	9	14	6
Machinist	6	64	6
	7	139	6
	8	213	14
	9	303	6
	10	315	6
Die Maker	7	229	14
	9	355	14
	10	391	14
	11	421	14
Instrument Maker	6	169	10
	7	245	10
	9	273	10

TABLE 5—*Concluded*

OCCUPATION	CLASS	WEEKS	
		A	B
Gage Maker	7	229	14
	9	355	14
	10	391	14
	11	421	14
Toolmaker	7	229	14
	9	355	14
	10	391	14
	11	421	14

Selecting Men to be Trained

THE training periods for skilled workers recorded above are average periods. Many of these, and other companies, require that before a man is given training to lift him from his present to a higher labor grade, he must show that he has the basic trade knowledge, and the capacity to benefit by the training.

This is sound, for it is a waste of time on the part of the training department, and of the man, and a useless tying up of much needed plant equipment to attempt to upgrade a man who does not have the ability or brains to qualify for the higher skilled job anyway.

Only 35% Helpers Good for Promotion

THERE is described below the experience of one company in selecting electrical helpers for training to journeyman grade. It found that only 35% of these helpers looked as if they would ever get to fully skilled status, no matter how much training they were given.

Four factors were considered in deciding upon the men who had a good chance of succeeding.

(1) Merit rating by present supervisors.

(2) Length of experience with the company.

(3) Knowledge of their trade or job. This was judged on the basis of their answers to trade questions relating to their present jobs. It was felt that if they had not, after years of experience in their jobs, been sufficiently ambitious or intelligent to learn all they could about them, then they were poor prospects for training for higher jobs.

Practical Trade Questions

SUCH trade questions are very practical ones, as may be seen from the following four, which will be used, possibly in a modified form, in the next step the company is going to take in selecting machine shop men for upgrading.

(a) Is a flat plate ½" x 16" x 36" ordinarily held on the planer for surfacing with (1) straight clamps, (2) planer jacks, (3) a planer vise, (4) poppets and toe dogs?

(b) If you are to turn an included angle of 30 degrees on the end of a piece of stock held in a lathe chuck, do you swing the handle end of the compound rest, (1) 30 degrees to the left, (2) 30 degrees to the right, (3) 60 degrees to the left, (4) 75 degrees to the left?

(c) Is a fillet (1) a concave curve, (2) a type of gauge, (3) the point of balance of a tool, (4) a convex curve?

(d) Can a spiral (helical) square cornered keyway be cut in a shaft on a miller with a (1) side mill, (2) slitting saw, (3) woodruff keyway cutter, (4) end mill?

Such trade questions, many of which have been prepared by the Extension Division of Purdue University, and the Research Division of the Unemployment Insurance Division of the Federal Security Agency, Washington, D. C., are quite suitable for use by master mechanics and machine shop foremen in aiding in the selection of men for upgrade training, or even for hiring new skilled workers.

(4) The last, and most important factor, taken into consideration was the intelligence of skilled workers who might be capable of improving their skill through training. This was determined through intelligence tests.

Negotiations with Union

THIS program ran into difficulty because the union felt that promotion from helper to journeyman classification should be based on seniority. But the examinations showed plainly that many men, with years of experience on the job, had not bothered to learn all they could about it, or were incapable of learning more, and so could not possibly be promoted or trained for promotion.

Under the emergency conditions prevailing in the industry, and the fact that an absence of ten skilled workers means that 100 semi- and unskilled workers cannot be hired, because there are not tools and properly maintained machines for them to operate, the union finally dropped its opposition to the plan.

Personnel Manager's Letter Starts Program

October, 1939

To: Mr. "X", Division Superintendent
From: Mr. "Y", Personnel Manager
Subject: Training Electrical Helpers

Following your instructions, during the past week we have given qualifying tests to sixty-four members of your electrical maintenance department for the purpose of selecting members for a training group in electricity. The tests used were the Otis Advanced Self Administering Test of Mental Ability, and the General Electrical Knowledge Test prepared by Mr. "Z" and others in this area under the direction of the State University.

In arriving at a composite test ranking for these employees, who were given the qualifying tests, the following arbitrary weights were given to each of the factors considered:

Otis Intelligence	40%
General Electrical	30%
Experience	20%
Merit Rating	10%
	100%

We realize that the above weights may be open to question, but we were of the opinion that it was necessary to establish standards in line with the purposes of the tests. Thus, we considered intelligence of greatest importance in determining those who have the capacity to justify training.

Recommendations

First: We are of the opinion that only twenty-three of the group tested have the mental capacity to effectively receive training. Consequently, we recommend that at least a trial group be restricted to that number at this time.

Second: We believe that the group percentile rankings (shown on the attached pages) will be helpful to the Superintendent of Electrical Maintenance from an Industrial Relations viewpoint in future questions of promotions, demotions, rates, or job assignments.

Third: We would recommend that the same procedure should be followed in testing lower rated machinists for instruction groups.

Fourth: In analyzing the information at hand as revealed in the test results, the following pertinent information will be of interest to your supervisors.

Night School Students Best

Employees who have pursued some night school studies rated eighty-two percent (82%) higher on the General Electrical Knowledge Test than those who, according to our records, have made no attempts to improve themselves by outside study.

The average Mental Age computed from the Otis Test of Mental Ability was 13.0 years. Since the average Mental Age of an adult group such as this is normally about 15 years of age, this group was slightly below normal.

There was a correlation of $-.065$ between test results on General Electrical Knowledge and the total Merit Rating score. This exceedingly small correlation seems to indicate no relationship at all between these two factors. Either the raters are not accurately rating the man on the actual knowledge of his job, or, the test used did not sufficiently measure the man's knowledge of electrical facts.

There was a correlation of $+.40$ between the foreman's overall Merit Rating and Intelligence as measured by the Otis Test. A correlation of this magnitude indicates a slight, but probably statistically significant relationship between these two factors. In other words, as a rule a man with more mental ability is usually rated slightly higher than a man with a lower mental ability.

Experience Does Not Guarantee Job Knowledge

There was a correlation of $+.023$ between Experience and General Electrical Knowledge as revealed by the test results. Here again the exceedingly low correlation probably indicates no relationship between these two factors. In

other words, by merely being exposed to electrical work over a period of years the worker is not absorbing the knowledge that should be required of him in order to obtain and fulfill a job requiring more knowledge and skill. This low relationship shows more clearly the specific necessity of a planned training program for workers of this type.

The results of these qualifying tests indicate a decided need for a planned training program of some nature. We believe that with the right type of training, the twenty-three men recommended have the mental capacity and basic knowledge to carry through a course of the type outlined to you previously in our memorandum of September.

Technical Scoring Method

For those who are interested in the technique used in arriving at a final composite score, which includes the four factors, there is given below a note describing the method used.

Each man is ranked according to his relationship to the rest of the group according to his scores on the qualifying tests. Since it would be impossible to use the raw or actual scores for comparative work, it was necessary to find and use the so called "Z" score. This means a score in terms of standard deviations from the arithmetic mean or average. By the use of the "Z" score, the individual results on all the qualifying factors were placed in common units and on a common basis.

In order to emphasize certain of the qualifying factors which we considered slightly more essential to the welfare of the group, the "Z" scores were then weighted by multiplying them by our previously determined weights. Then, these weighted "Z" scores were totaled and percentile ranking determined for each individual. The percentile rank means, in ordinary terms, the relative position of one individual to the rest of the group. Thus, a percentile rank of 80 would mean that 80% of the group did not obtain as high a composite score as this individual did, and 20% obtained higher composite scores.

Skilled Labor Supply Inventory

THE National Defense Commission recommends that companies take an inventory of their working force, so that they may be certain that they know the skills and potentialities of their employees, and can train and upgrade them accordingly. This is a major undertaking.

One company did this late in 1939, in anticipation of a 50% increase in business in 1940. Their experience is reported here, and shows what must be done.

Information to Be Gathered

ESTIMATES must be obtained from the production department as to physical output in different products. This must be related to tool building and maintenance; to the present skills in the plant; to the potentialities of employees for promotion, with or without further training; to graduating apprentices; to learning periods, and the productivity of learners and trainees; to induction periods, or time for hired and transferred employees to reach normal proficiency; to number of laid off employees who may be expected to return to the company; to the age distribution of employees; to the number of semi-skilled workers, who seem to have the capacity for promotion into skilled jobs.

And finally all these factors must be related together, to obtain final estimate of the numbers of employees to be promoted, trained, hired and recalled, for each occupation, each month.

Conferences with Line Organization

THE material here presented illustrates these methods as attempted in a company. It is evident that the correlation of the various factors must have been accomplished in conferences of the line organization with the personnel department. These conferences are not reported here, as they would serve to identify the company, and expose its private business information.

The material presented, however, should serve as a useful guide to any other company, wishing to make such a survey of its own situation, in whole or in part.

Labor Requirements Survey

STUDIES which were made in past years to determine needs for production and skilled workers in an expanding business period had proved of such value in meeting the requirements, that a comprehensive study was undertaken in 1939 to

determine the requirements of an assumed increase in production of 50% which was not considered improbable based on inquiries for and estimates of the probable demand for the company's products. This study was for the purpose of determining—

(a) Number of workers by occupations available within the plant who had been transferred or downgraded and already possessed skills for higher grade work.

(b) Number and what employees in the plant had partially developed skills as a result of rotational or progression training.

(c) Number and names of employees laid off who had had experience in semi-skilled or skilled work or had developed skills as a result of rotational or progression training.

(d) Training required to make best use of available skills.

(e) Possible employment or reemployment problems in view of the possible tightening of the labor situation.

For the purpose of determining number of employees within the plant qualified with little or no training to return to higher skilled occupations, the experience records of 1487 employees in "major" occupations as of October 1937 were reviewed. Estimates were prepared as to the number of employees that would have to be recalled or hired, to show the number and kind by occupations, and pertinent information as to specific employees who might be rehired to meet specific needs. Data was accumulated as to training periods for training use and for information of line organizations.

While the data is intended to focus attention primarily on skilled and semi-skilled labor, there is included information relating to all direct labor occupations for male workers, to conform with a policy of training employees for progression in the organization.

Final Estimates

THE final outcome of this survey resulted in a table, of which that given below is a representative part (see Table 6).

25% of Employees Found Promotable

THE inventory also showed that 25% of employees on the payroll were capable of going into higher skilled jobs, either straight away, or after further specific training.

Also the number of laid off employees, who might be recalled to their former skilled jobs, was determined. The rehiring of these employees, rather than completely new ones, would considerably increase the rate at which the plant would attain full productivity.

A summary of the results of this aspect of the inventory is given below.

SUMMARY OF AVAILABLE CANDIDATES FOR OPENINGS ON MALE HOURLY SHOP OCCUPATIONS (12/1/39)
(Clerical Occupations and Supervisors Not Included)

Number of Male Hourly Shop Occupations considered (Clerical occupations and supervisors not included)	262
Number of present employees on these occupations	2257

Number of these employees who were demoted to a lower level in same occupation due to lack of work since July 1, 1937. These employees are to be returned to their higher level jobs as openings occur..... 206 (9%)

Number of others of these employees who are capable of assuming greater responsibilities without any further training or experience (Supervisory recommendations).... 197 (9%)

Number of others of these employees who will be capable of assuming greater responsibilities after further specific training or experience. (Supervisory recommendations)..... 170 (7%)

Number of individuals who worked on these occupations but were laid off due to lack of work. These employees are candidates for rehiring when openings occur..... Calculated but not given

TABLE 6

ESTIMATED PERSONNEL REQUIREMENTS—BASED ON ASSUMED 50% INCREASE IN PRODUCTION
(This type of estimate was made for all occupations in the plant)

OCCUPATION	12/1/39 PRESENT FORCE	1940 (NO. TO BE HIRED EACH MONTH)						TOTAL
		Jan.	Feb.	Mar.	Apr.	May	June	
Bench Hand	201	19	13	11	19	6	4	
Cabinet Maker	12							
Carpenter	7	1						
Crane Operator	5	1		1				
Die Maker	19		1		1			
Electrician	58	8	1	1	3	1		
Gardener	2				2			
Gauge Maker	1							
Instrument Maker	16			2	2			
Janitor	51	2	3	5				
Layout Operator	25	3	1	2	2	1		
Machine Oper.—Drill Press	74	10	7	5	7			
Machine Oper.—Lathe	28	4	3	2		1		
Machine Oper.—Punch Press	58	7	4	2	1	1		
Machine Oper.—Screw	21	1	2	3	2			
Machinist	60	7	4	1	1			
Machine Setter	30	4		2	2			
Millwright	33	4		1	1			
Painter	10		2	1	1			
Pipefitter	25		1		1			
Restaurant Hand	35		2	2	2			
Stockkeeper	42	2	1	3	3	2	1	
Tool Maker	58	7	7	1	4	1	1	
Welder	26	1	2	1				
Totals (For all Occupations):								
Men	2238	260	136	151	158	39	10	2992
Women	549	61	33	29	46	7	3	728
Grand Total	2787	321	169	180	204	46	13	3720
Increase								34%

Supervisors Recommend Promotable Workers

THE development of these figures was attained through personnel records, and recommendations of the supervisory organization (see Table 7).

TABLE 7

PLANT SITUATION BY OCCUPATIONS AND LABOR GRADES

OCCUPATIONAL CLASSIFICATION	(1) LABOR GRADE	(2) NUMBER ON ROLL	(3) PRESENT EMPLOYEES POTENTIALITY RECOMMENDATION			(4) EMPLOYEES DOWN-GRADED FROM OCCUPATION	(5) LAID OFF EMPLOYEES	(6) TO BE HIRED FROM OUTSIDE MARKET
			1	2	3			
Welder Arc & Acet.	5	0	0	0	0	0	1	
	7	15	0	2	2	0	4	
	8	3	0	0	0	0	0	
Total		18	0	2	2	0	5	
Lathe Operator	7	10	0	1	1	0	9	
	8	4	0	0	0	1	6	
	8	0	0	0	0	0	1	
	9	3	0	0	0	0	1	
Total		17	0	1	1	1	17	
Tester, Electrical	7	2	0	1	1	0	0	
	8	16	2	6	2	0	0	
Total		18	2	7	3	0	0	
Electrician	7	5	0	1	1	0	38	(Calculated but not shown)
	8	18	3	2	2	0	23	
	9	24	4	1	2	0	6	
Total		47	7	4	5	0	67	
Millwright	7	7	0	0	0	0	22	
	8	18	2	0	0	0	25	
	9	8	2	0	0	0	1	
Total		33	4	0	0	0	48	
Detail Maker	4	1	1	0	0	0	4	
	5	0	0	0	0	0	1	
	6	7	1	1	2	0	16	
	7	9	0	2	1	2	25	
	9	19	6	2	2	0	10	
Total		36	8	5	5	2	56	

Personnel records showed by occupations, labor grades and merit ratings the men who had been demoted during the business recess of 1938, and who were still on the payroll of the company (Column 4). Personnel records also showed by

occupations, labor grades and merit ratings the men who had been laid off (Column 5).

The supervisors were asked to supplement this information by making "potentiality recommendations" (Column 3) as to: (1) Those employees who were qualified to return to their former higher level jobs. (2) Those capable of assuming greater responsibilities with no further training or experience. (These employees are immediate candidates for promotion to skilled jobs not previously held with the company.) (3) Those capable of assuming greater responsibilities after further training and experience.

Taking all these factors into consideration, and knowing from the production department the number of men required in each occupation, by labor grade, it was possible to determine the number of men in each classification that would have to be hired from the outside labor market.

The personnel department then made an analysis of the sources from which it obtained employees in the business pick-up of 1935–37, in a tight skilled labor market. The results of this analysis are shown in Table 8 below, but may be summarized here as follows:

931 skilled workers were hired.
Of these 220 were former employees and 711 new workers.
574 were drawn from the ranks of the unemployed.
330 were employed in the local area and left their present jobs.
27 were employed outside the area, and left their jobs and moved.
Only 10 were obtained through advertizing.
95 were obtained through public employment agencies.
245 were obtained through personal recommendations of present employees.
552 were fully experienced when hired.
269 were partially experienced and required further training.
119 had no experience for the job hired for, and had to be trained.
417 received a higher rate of pay with the company than they had previously been getting.
352 took a reduction in pay to come to work for the company.

Company Can Better Hiring Methods

As a result of this analysis the company feels that it now knows better how to obtain skilled workers. It feels that advertising is almost useless, as is out-of-town recruiting. It feels that public employment agencies, such as the State Employment Service is not yet sufficiently reliable as a source.

It feels that in the main it must rely on its own employment office to keep more closely in touch with former employees, to build up the reputation of the company in the community, and to develop means of getting into contact with skilled unemployed workers in the local area, through church groups, social agencies, etc.

TABLE 8

Analysis of Hirings

Skilled Workers (Sept. 1935 to Sept. 1937 Incl.)

	TOTAL HIRED	NEW	RECALLED	FROM UNEMPLOYED		WERE EMPLOYED AT TIME OF EMPLOYMENT				THROUGH OWN EMPLOYMENT OFFICE		PUBLIC AGENCY		ADVERTISING		PERSONAL RECOMMENDATIONS		EXPERIENCED		PARTIAL EXPERIENCE		INEXPERIENCE		RATE INCREASE		DECREASE		SAME	
				N	R	In local area		In outside district																					
						N	R	N	R	N	R	N	R	N	R	N	R	N	R	N	R	N	R	N	R	N	R	N	R
1 Box Makers	12	7	5	7	3		2			4	4					3	1		2	2	2	5	1	5	2		3	2	
2 Buffers	5	5	0	5						2						3		5						3		2			
3 Cabinet Makers	8	5	3	4	2	1	1			3	2					2	1	4	2	1	1				3	5			
4 Carpenters	10	7	3	6	2	1	1			3	3	3				1		7	3					1	1	6	2		
5 Detail Makers	62	47	15	22	10	23	5	2		26	13	7				14	2	30	11	16	4			14	9	22	4	11	2
6 Die Makers	41	33	8	10	2	22	6	1		15	8	4				14		33	8					15	6	9	2	9	
7 Drill Press Opr.	149	113	36	87	28	26	8			59	33	2				52	3	15	7	44	15	54	14	45	16	42	11	26	9
8 Electricians	54	44	10	27	6	17	4			20	9	16	1			8		39	10	5				15	3	25	3	4	4
9 Grinding Mach. Oprs.	14	9	5	2	1	6	4	1		6	4	1		1		1	1	7	5	2				6	2			3	3
10 Helpers, Plant Trades.	111	98	13	75	12	23	1			57	10	3	1			38	2	6	6	65	5	27	2	52	3	35	7	9	3
11 Instrument Maker	3	2	1	2	1					1	1					1		1	1						1	1		1	
12 Lathe Operators	28	19	9	10	5	7	4	2		9	7	3				7	2	17	7	2	2			7	3	6	5	6	1
13 Layout Men	21	14	7	8	4	6	3			10	6	3				1	1	9	3	5	4			4	2	7	4	3	1
14 Machine Setters	4	2	2	1	1	1	1			1	2	1							2	2					1		1	2	
15 Machinists	60	48	12	25	4	19	8	4		28	9	9	1	3		8	2	43	11	5	1			23	8	19	2	6	2
16 Masons	6	6	0	5		1				4						2		6						1		3		2	
17 Milling Mach. Oprs.	31	25	6	14	2	11	4			14	3	5	2	1	1	5	1	15	5	9		1		10	3	9	2	6	1
18 Millwright	62	40	22	23	12	16	9	1	1	19	18	10	2			11	2	27	18	13	3		1	18	17	18	3	4	2
19 Painter	28	27	1	20		7	1			14		2	1			11		24	1	3				13	1	11		3	
20 Pipe Fitters	10	7	3	6		1			3	3	2	1		1		2	1	6	3	1				2	2	3		2	1
21 Platers	2	2	0	1		1				2								2						2					
22 Punch Press Oprs.	76	63	13	44	8	18	5			43	13	5				15		27	9	28	3	8	1	34	5	23	7	6	1
23 Sanders	4	3	1	2	1			1		2	1					1		1	1			2		2	1			1	
24 Sawyers	8	4	4	3	2	1	1	1		1	3					2	1	1	3	2	1			1	2	1		2	2
25 Screw Mach. Oprs.— Auto	13	9	4	4	1	1	2	4	1	3	4	4		1		1		9	4					4	1	4	1	1	2
26 Sheet Metal Workers	10	8	2	4	2	4				6	2	1				1		5	1	2	1	1		4	1	3		1	1
27 Sprayers	4	2	2	2	1		1			1	1					1	1	1	1	1	1				1	2	1		1
28 Toolmakers	75	49	26	22	10	24	16	3		30	22	4	1	2		13	3	47	26	2				22	13	18	8	9	5
29 Welders, Gas & Arc	5	5	0	2		3				2		2				1		5						1		4			
30 Welders—Spot	4	3	1	1		2			1	2	1					1		2		1	1			2	1	1			
31 Wood Finishers	11	5	6	4	5		1	1		4	6					1			6	3		2		2	1	3	4		2
Total Skilled Workers	931	711	220	449	125	242	88	20	7	395	187	86	9	9	1	221	24	396	156	215	54	100	19	308	109	282	70	121	41

N signifies new employees. R signifies rehired former employees.

Personnel Procedures

THE results obtained in this labor requirements survey, herein described, have in a large measure been made possible through the use of basic personnel procedures. Recognizing the importance of having accurate estimates of personnel required for fluctuating periods of the business, and other adequate appraisals to aid in moving and training employees under these varying conditions, led supervisors in the organization to suggest procedures which would permit objective and fair judgments in connection with the development and placement of employees.

As a result of this supervisory interest, particular emphasis was given in 1935, by both the personnel and line organizations, to such procedures as job analysis, employee inventory, merit rating, job families and in the forecasting of personnel requirements. A short explanation of these procedures seems appropriate, as a part of this labor requirements survey, recognizing, however, that these procedures are not new, and are found in many other industrial organizations.

Job Analysis

ACCURATE and adequate information relating to job and worker requirements is a basic need in carrying out any personnel program effectively. Detailed job analysis has therefore been used in employment work, testing, training and upgrading. Such job analysis information was obtained on jobs, in all organizations, in order to provide a base for personnel action on a plant-wide basis. With trained analysts, and through the use of a plant manual, a uniform approach and evaluation is made of all jobs in the plant.

These analyses supply basic information as to job duties; job requirements in terms of working conditions, hazards, learning period; work requirements in terms of preferred age, experience, practical knowledge, vocational abilities and personal qualities.

Employee Inventory

IT HAS seemed to us that an employee inventory to record an employee's experience, education, types of experience and job preferences, is a necessary requirement in carrying out a well-rounded personnel program that has systematic employee development as one of its important factors.

This information is obtained through supervisors, supplemented by an interview by them with employees, recorded on an inventory form, and the supervisor is required to make a definite recommendation as to the steps that should be taken to develop the employee beyond his present place in the organization.

Merit Rating

MERIT ratings, which seek to objectively determine the performance standards of the individual employee, and incidentally include specified judgment

values by supervisors, are also considered essential in providing the opportunities to those who best merit them. The merit rating plan used limits, in so far as possible, subjective judgments, and appraisals are made as objectively as possible.

Job Families

To best utilize transferable skills possessed by employees, job analyses information is used in an effort to relate associated jobs based on their skill and knowledge requirement patterns. It is felt that present tests, and others which may be developed, make it possible to measure employee qualifications, not for a single occupation, but for a family of jobs with similar characteristics, as an aid to supervisory judgment in determining potentialities of employees.

Forecast of Personnel Requirements

In forecasting personnel requirements, information of value in supervisory training, and in management discussions, is provided which enables the management and the line organization to better anticipate problems that will have to be met as business expands, and to organize training programs to meet those needs, without serious interruption of work schedules, even though they involve transfer of employees from one class of work to another.

It is our feeling that the use of these procedures has made it possible to consider more objectively the individuals, and their qualifications, on a plant-wide basis, has also made for more effective placement, and facilitated upgrade training beyond that which could otherwise have been expected.

The study, here reported, of ways of obtaining sufficient skilled workers for defense industries is contained in the October and November issues of the Personnel Journal.

Part II, (November 1940) will deal with:

Placement Bulletin for Plant
Improved Toolroom Practices
Speeding up Training
Training on the Job
Apprentice Training Costs
Wright Aeronautical Plan
Doubling the Labor Supply
Output per Skilled Worker Increased
Recommendations
National Defense Commission Plans